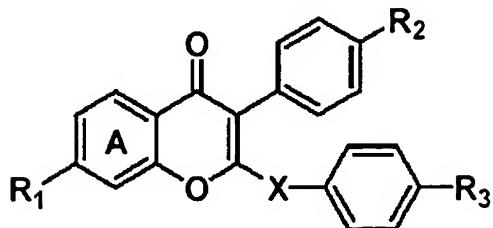


CLAIMS

The invention claimed is

1. A compound of formula A:

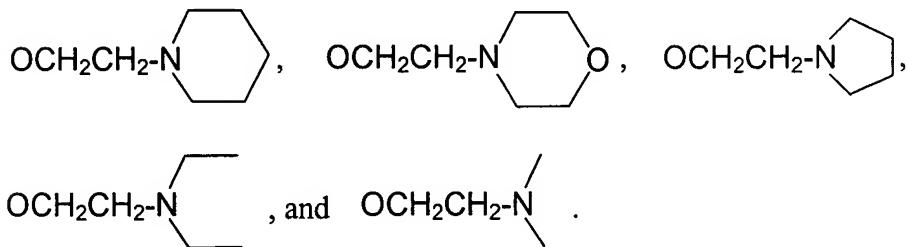


wherein

X is selected from the group consisting of O, N, S, SO, and SO<sub>2</sub>;

R<sub>1</sub> and R<sub>2</sub> can be the same or different and are selected from the group consisting of H, OH, OCH<sub>3</sub>, OCH<sub>2</sub>CH<sub>3</sub>, OCH<sub>2</sub>C<sub>6</sub>H<sub>5</sub>, NH<sub>2</sub>, NHCH<sub>3</sub>, N(CH<sub>3</sub>)<sub>2</sub>, CN, CH<sub>3</sub>, CH<sub>2</sub>CH<sub>3</sub>, CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>, CH(CH<sub>3</sub>)<sub>2</sub>, C(CH<sub>3</sub>)<sub>3</sub>, NO<sub>2</sub>, F, Cl, Br, CF<sub>3</sub>, SH, SCH<sub>3</sub>, SCH<sub>2</sub>CH<sub>3</sub>, OCOCH<sub>3</sub>, OCOC(CH<sub>3</sub>)<sub>3</sub>, and OCOCH<sub>2</sub>COOH;

R<sub>3</sub> is selected from the group consisting of H, OH, OCH<sub>3</sub>, OCH<sub>2</sub>CH<sub>3</sub>, NH<sub>2</sub>, NHCH<sub>3</sub>, N(CH<sub>3</sub>)<sub>2</sub>, NO<sub>2</sub>, CN, CH<sub>3</sub>, CH<sub>2</sub>CH<sub>3</sub>, CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>, CH(CH<sub>3</sub>)<sub>2</sub>, C(CH<sub>3</sub>)<sub>3</sub>, F, Cl, Br, CF<sub>3</sub>, SH, SCH<sub>3</sub>, SCH<sub>2</sub>CH<sub>3</sub>,



2. The compound of claim 1, wherein

X is selected from S and O;

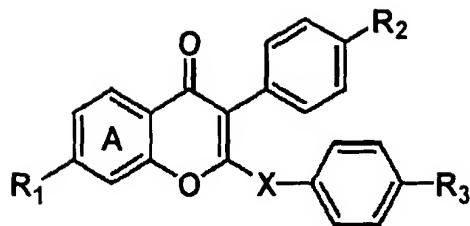
R<sub>1</sub> is selected from OH, OCH<sub>3</sub>, and OC<sub>6</sub>H<sub>5</sub>;

R<sub>2</sub> is selected from H, OH, CH<sub>3</sub>, and OCH<sub>3</sub>; and

R<sub>3</sub> is selected from OH and 2-(1-piperidinyl)ethoxy.

3. The compound of claim 2, wherein X is S, R<sub>1</sub> is OH, R<sub>2</sub> is OCH<sub>3</sub>, and R<sub>3</sub> is 2-(1-piperidinyl)ethoxy.
4. The compound of claim 2, wherein X is S, R<sub>1</sub> is OC<sub>6</sub>H<sub>5</sub>, R<sub>2</sub> is OCH<sub>3</sub>, and R<sub>3</sub> is OH.
5. The compound of claim 2, wherein X is S, R<sub>1</sub> is OH, R<sub>2</sub> is OH, and R<sub>3</sub> is OH.
6. The compound of claim 2, wherein X is S, R<sub>1</sub> is OC<sub>6</sub>H<sub>5</sub>, R<sub>2</sub> is OCH<sub>3</sub>, and R<sub>3</sub> is 2-(1-piperidinyl)ethoxy.
7. The compound of claim 2, wherein X is O, R<sub>1</sub> is OC<sub>6</sub>H<sub>5</sub>, R<sub>2</sub> is OCH<sub>3</sub>, and R<sub>3</sub> is 2-(1-piperidinyl)ethoxy.
8. The compound of claim 2, wherein X is O, R<sub>1</sub> is OH, R<sub>2</sub> is OCH<sub>3</sub>, and R<sub>3</sub> is 2-(1-piperidinyl)ethoxy.
9. A one-pot method for preparing a 2-(alkylthio)isoflavone comprising the steps of:
  - a. providing a mixture of a deoxybenzoin, carbon disulfide, alkyl halide, and tetrabutylammonium hydrogensulfate;
  - b. adding aqueous sodium hydroxide to the mixture while stirring;
  - c. reacting the mixture until the 2-(alkylthio)isoflavone is formed.
10. The method of claim 9 wherein the mixture is allowed to stir for about 3 to about 7 hours after the addition of the sodium hydroxide.
11. The method of claim 9 further comprising the step of separating the 2-(alkylthio)isoflavone from the reaction mixture.
12. The method of claim 11 further comprising the step of purifying the 2-(alkylthio)isoflavone compound.

13. A method of preparing a 2-heterosubstituted 3-aryl-4H-benzopyran-4-one compound comprising the steps of:
  - a. selecting a 2-(alkylthio)isoflavone;
  - b. optionally protecting potentially reactive groups on the 2-(alkylthio)isoflavone;
  - c. oxidizing the alkylthio group to a alkylsyfonyl group; and
  - d. substituting the alkylsulfonyl group with a heteroalkyl or heteroaryl group to form the 2-heterosubstituted 3-aryl-4H-benzopyran-4-one compound.
14. The method of claim 13 wherein the oxidation step is carried out using *m*CPBA in a polar aprotic solvent under reflux conditions.
15. The method of claim 15 wherein the polar aprotic solvent is CH<sub>2</sub>Cl<sub>2</sub>.
16. The method of claim 13 wherein alkylsulfonyl group is substituted with a thioaryl group.
17. The method of claim 16 further comprising the step of substituting the thioaryl group with an ethylpiperidinyl group to form a 4-[2-(1-piperidinyl)ethoxy]thiophenyl group at the 2-position of the 2-heterosubstituted 3-aryl-4H-benzopyran-4-one compound.
18. The method of claim 17 further comprising the step of deprotecting the 2-heterosubstituted 3-aryl-4H-benzopyran-4-one.
19. The method of claim 13 further comprising the step of deprotecting the 2-heterosubstituted 3-aryl-4H-benzopyran-4-one.
20. A method for treating, inhibiting, or delaying the onset of a cancer in a subject in need of such treatment; the method comprising administering a therapeutically effective amount of compound A:

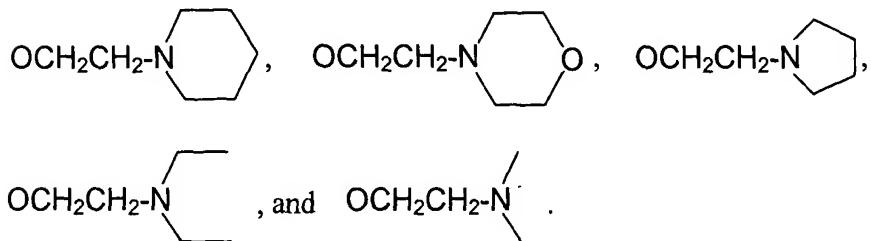


wherein

X is selected from the group consisting of O, N, S, SO, and SO<sub>2</sub>;

R<sub>1</sub> and R<sub>2</sub> can be the same or different and are selected from the group consisting of H, OH, OCH<sub>3</sub>, OCH<sub>2</sub>CH<sub>3</sub>, OCH<sub>2</sub>C<sub>6</sub>H<sub>5</sub>, NH<sub>2</sub>, NHCH<sub>3</sub>, N(CH<sub>3</sub>)<sub>2</sub>, CN, CH<sub>3</sub>, CH<sub>2</sub>CH<sub>3</sub>, CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>, CH(CH<sub>3</sub>)<sub>2</sub>, C(CH<sub>3</sub>)<sub>3</sub>, NO<sub>2</sub>, F, Cl, Br, CF<sub>3</sub>, SH, SCH<sub>3</sub>, SCH<sub>2</sub>CH<sub>3</sub>, OCOCH<sub>3</sub>, OCOC(CH<sub>3</sub>)<sub>3</sub>, and OCOCH<sub>2</sub>COOH;

R<sub>3</sub> is selected from the group consisting of H, OH, OCH<sub>3</sub>, OCH<sub>2</sub>CH<sub>3</sub>, NH<sub>2</sub>, NHCH<sub>3</sub>, N(CH<sub>3</sub>)<sub>2</sub>, NO<sub>2</sub>, CN, CH<sub>3</sub>, CH<sub>2</sub>CH<sub>3</sub>, CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>, CH(CH<sub>3</sub>)<sub>2</sub>, C(CH<sub>3</sub>)<sub>3</sub>, F, Cl, Br, CF<sub>3</sub>, SH, SCH<sub>3</sub>, SCH<sub>2</sub>CH<sub>3</sub>,



to the subject in need of such treatment.

21. The method of claim 20 wherein the cancer is selected from the group consisting of breast cancer, leukemia, non-small cell lung cancer, colon cancer, CNS cancer, melanoma, ovarian cancer, renal cancer, prostate cancer, bladder cancer, and lymphoma.
22. The method of claim 20 wherein the cancer is hormone-dependent breast cancer.
23. The method of claim 20 wherein the compound suppresses proliferation of human breast cancer cell lines without significantly binding with estrogen receptors (ERs).